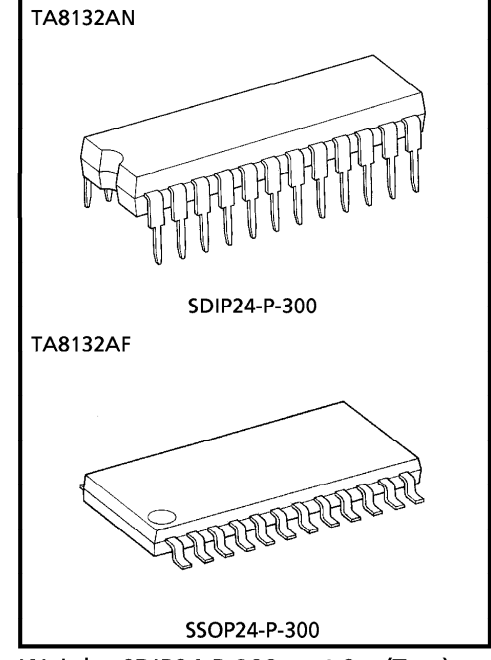
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT

TA8132AN, TA8132AF

SILICON MONOLITHIC

3V AM / FM IF + MPX
(for Digital Tuning System)

TA8132AN, TA8132AF are the AM / FM IF + MPX system ICs, which are designed for DTS Radios.
These are included many functions and these can be used for Digital Tuning System with IF Counter.

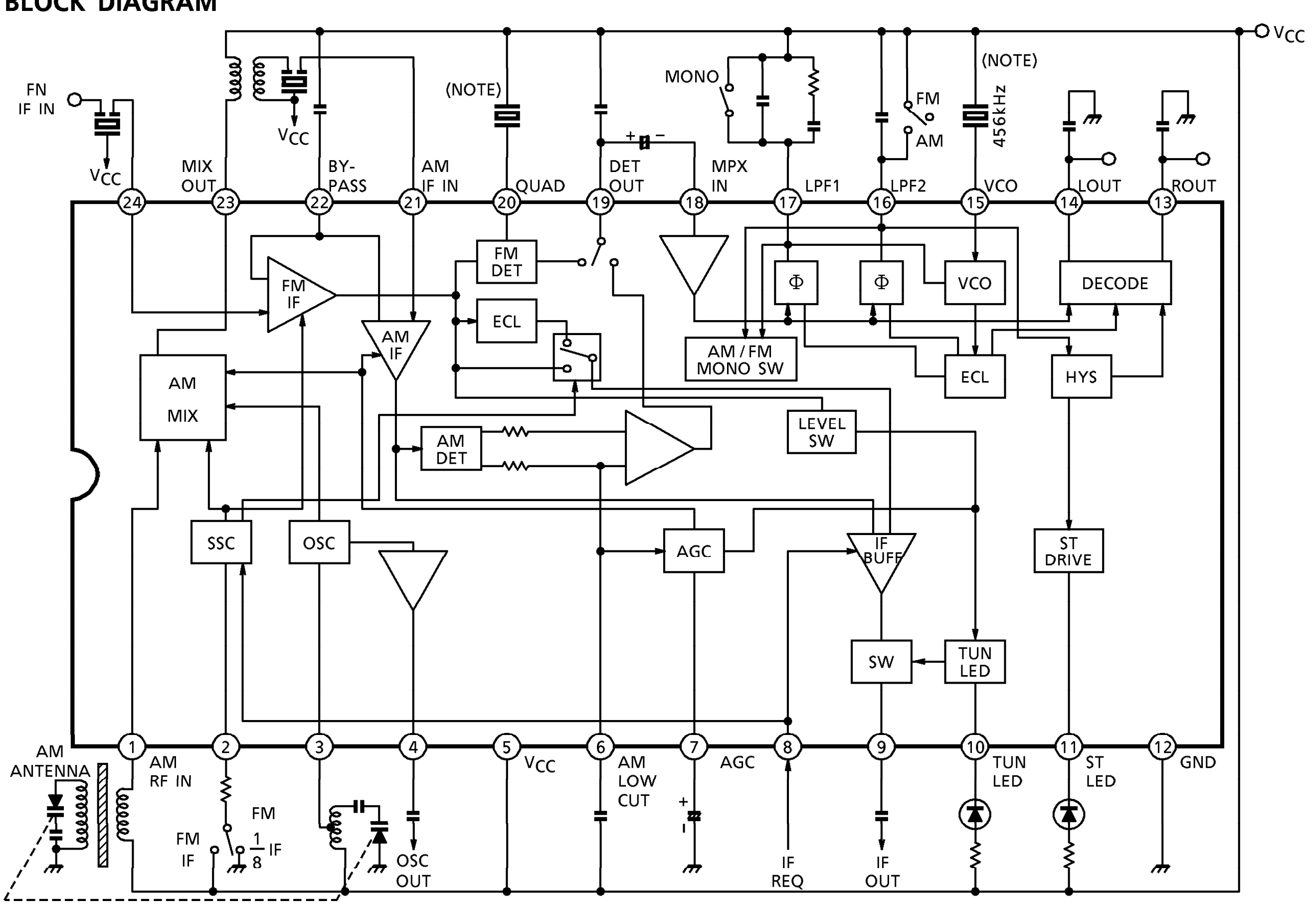


Weight SDIP24-P-300 : 1.2g (Typ.)
SSOP24-P-300 : 0.31g (Typ.)

FEATURES

- Built-in AM / FM IF and FM Stereo PLL Multiplex Decoder.
- Suitable for combination with Digital Tuning System which is included IF Counter.
  - ○ One terminal type AM / FM IF Count Output (Auto Stop Signal) for IF Counter of Digital Tuning System.
    FM : 10.7MHz } changeable by
    1.3375MHz (1 / 8 dividing) } external switch
    AM : 450kHz
  - ○ Built-in Mute Circuit for IF Count Output.
    It is controlled by the IF Request Signal from Digital Tuning System,
    Pin⑧ level : High→Come out
    Low →Non output
  - ○ Adjustable for IF Count Output Sensitivity by External Resistance of pin②.
- For adopting Ceramic Discriminator and Ceramic Resonator, it is not necessary to adjust the FM Quad Detector Circuit and MPX VCO Circuit.
- Built-in One terminal type AM Low Cut Circuit.
- Operating Supply Voltage Range (Ta = 25°C)
  $V_{CC (opr.)}$ = 1.8V~8.0V

BLOCK DIAGRAM



(NOTE)
We recommend
Ceramic resonator : CSB456F18
Ceramic discriminator : CDA10.7MG18 (MURATA MFG CO., LTD)

EXPLANATION OF TERMINALS

PIN No.	ITEM	INTERNAL CIRCUIT	DC VOLTAGE (V) (at no signal)	
			AM	FM
1	AM RF IN	V_{CC} (5), (1), GND (12)	3.0	3.0
2	• IF Count Output Sensitivity Adjust Terminal • FM IF Divider Control Terminal	V_{CC} (5), GND (12), (2)	—	—
3	AM OSC	V_{CC} (5), BUFF AMP, (3), ALC, GND (12)	3.0	3.0
4	AM OSC OUT	V_{CC} (5), AM OSC, 750Ω, (4), GND (12)	2.7	3.0
5	V_{CC}	—	3.0	3.0
6	AM LOW CUT	V_{CC} (5), 22kΩ, GND (12), (6)	2.3	2.3

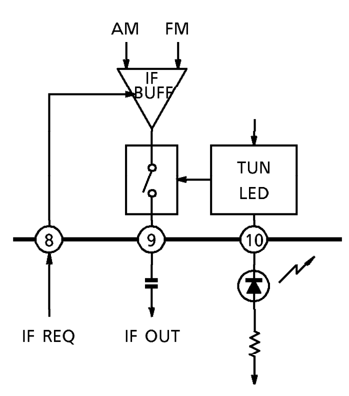
PIN No.	ITEM	INTERNAL CIRCUIT	DC VOLTAGE (V) (at no signal)	
			AM	FM
7	AGC		0.25	0.35
8	IF OUT SW		—	—
9	IF OUT		3.0	3.0
10	TUN LED (Tuning LED)		—	—
11	ST LED (Stereo LED)		—	—
12	GND	—	0	0
13 14	R-OUT L-OUT		1.0	1.0

PIN No.	ITEM	INTERNAL CIRCUIT	DC VOLTAGE (V) (at no signal)	
			AM	FM
15	VCO	VCC 5, 15, GND 12	2.5	2.5 (VCO Stop mode)
16	LPF2 ● LPF Terminal for Synchronous Detector ● Bias Terminal for AM / FM Switch Circuit $V_{16} = V_{CC}$ →AM V_{16} = open→FM	16, AM / FM SW, GND 12	3.0	2.2
17	LPF1 ● LPF Terminal for Phase Detector ● VCO Stop Terminal $V_{17} = V_{CC}$→VCO Stop	17, DC AMP, GND 12	2.7	2.2
18	MPX IN	18, GND 12	0.7	0.7
19	DET OUT	VCC 5, AM, FM, 19, GND 12	1.1	1.1

PIN No.	ITEM	INTERNAL CIRCUIT	DC VOLTAGE (V) (at no signal)	
			AM	FM
20	QUAD (FM QUAD. Detector)		2.4	2.1
21	AM IF IN		3.0	3.0
22	BY-PASS (AM IF AMP / FM IF AMP BY-PASS)		2.3	2.8
23	AM MIX OUT		3.0	3.0
24	FM IF IN		3.0	3.0

APPLICATION NOTE

1. How to control the IF Count Output Signal (pin⑨ output)



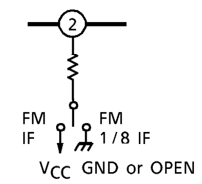
		TUN LED	
		ON	OFF
V_8	H	Come out	Non output
	L	Non output	Non output

○ Whether or not there is the IF Count output signal (pin⑨ output) is determined by the AND of the pin⑧ control voltage : V_8 and tuning LED on / off switching.
In the condition of
V_8 : High (Active High, $V_{TH} = 0.8V$ (Typ.))
TUN LED : ON ($V_{in} \geqq V_L + 2dB\mu V$ EMF (Typ.))
the IF count output signal comes out from the pin⑨.
In the case of the Tuning LED function is not needed, it doesn't matter the pin⑩ is opened.

○ The output impedance of pin⑨ is 1.5kΩ (Typ.) (cf. P.4)
It is possible to reduce the IF count output signal level to add the resistance between the pin⑨ and the V_{CC} line.

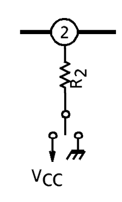
○ The signal waveform is the rectangular wave, and the level is 500m$V_{p\text{-}p}$ (Typ.)

2. How to control the Divider of FM IF



Switch
(V_{CC} : 10.7MHz output
GND or Open : 1.3375MHz output (1 / 8 dividing))

3. How to adjust the IF Count Output Sensitivity

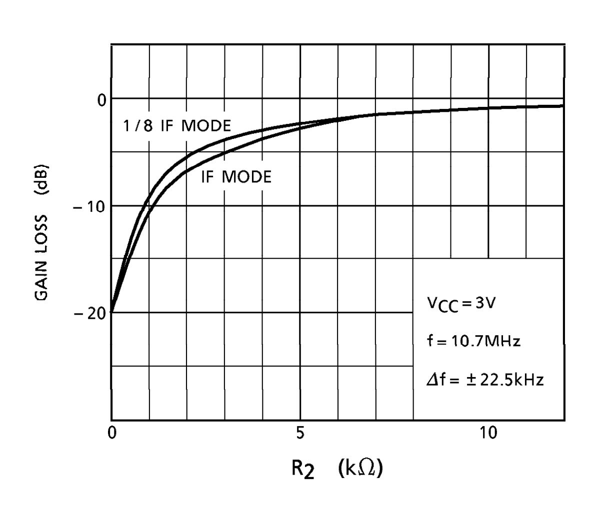


○ The IF Count Output Sensitivity (Search sensitivity)
Can be adjusted by varying the IF AMP gain for FM and varying the Mixer gain for AM. This setting is made by changing the value of external resistance R_2 which is connected to pin②.

○ However, this is only possible at the Auto-Tuning Mode. (external voltage supplied to pin⑧ is at High level.) The original again returns while receiving a broadcast station (supplied voltage to pin⑧ is at Low level.)

○ The Gain Loss of FM IF AMP

		R2	
		0Ω	10kΩ (Note)
MODE	IF (10.7MHz)	−20dB	−1dB
	1/8 IF (1.3375MHz)	−20dB	−1dB

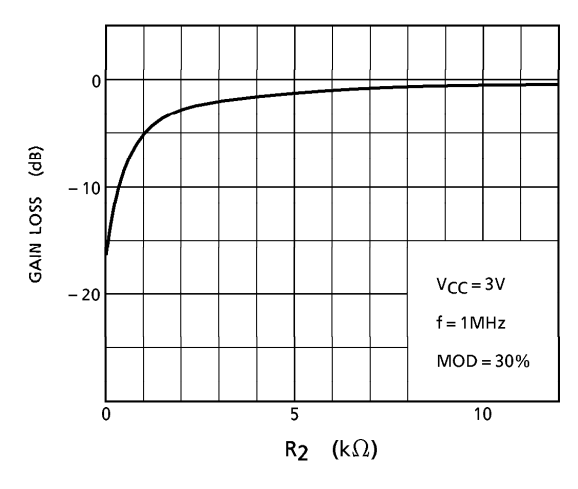


(Note)

- In the condition of the 1/8 IF Mode, it is possible to set up $R_2 = \infty$ (open).
- In the condition of IF Mode, it is necessary to set up the value of R_2 under 10kΩ. When the R_2 is over 10kΩ it is feared that the Mode is change to the 1/8 IF Mode.

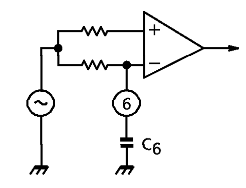
○ The Gain Loss of AM Mixer

R2	
0Ω	10kΩ
−16dB	−1dB



4. AM Low-Cut Circuit

○ The AM Low-Cut action is carried out by the bypass of the high frequency component of the positive-feedback signal at the AF AMP stage. The external capacitor : C_6 by-passes this component.



○ The cut-off frequency f_L is determine by the internal resistance 22kΩ (Typ.) and the external capacitor C_6 as following ;

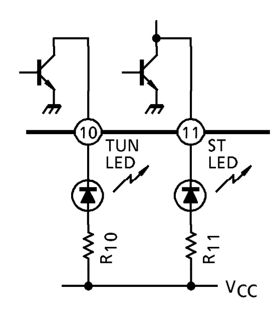
$$f_L = \frac{1}{2 \times \pi \times 22 \times 10^3 \times C_6} \text{ (Hz)}$$

○ In the case of the AM Low-Cut function is not needed, set up the value of C_6 over 0.47μF. In the condition of $C_6 \geqq 0.47\mu F$, the frequency characteristic has flat response at the low frequency.

5. AM Local Oscillator Buffer Output

- ○ The output impedance of AM Local Oscillator Buffer Output pin (Pin④) is 750Ω (Typ.) (cf. P.3)
- ○ It is possible to reduce the output level to add the resistance between the pin④ and V_{CC} line. The signal waveform is the rectangular wave, and the level is $500mV_{p-p}$ (f_{OSC} = 1.45MHz, Typ.)
- ○ The higher local oscillation frequency (f_{OSC}) to be, the lower buff output level to be owing to the load capacity. So, in the case that it is connected to other circuits, take care of the input capacity of these circuits and stray capacity of wire.

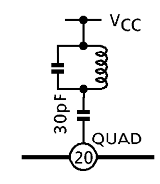
6. Tuning LED Driver and Stereo LED Driver

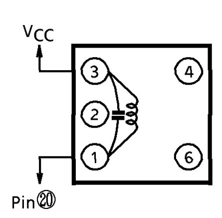


- ○ The Tuning LED Driver and Stereo LED Driver don't have current limit resistance shown in the right figure. So, it is necessary to add the current limit resistance : R_{10}, R_{11}.
- ○ Set up the values of R_{10}, R_{11} to keep the drive currents ID10, ID11 under 10mA.

7. FM Detection Circuit

For the FM detection circuit, detection coil is able to use instead of ceramic discriminator. Recommended circuit and recommended coil are as follows.
In this case, please take care that $V_{in\ (lim.)}$ falls a little.





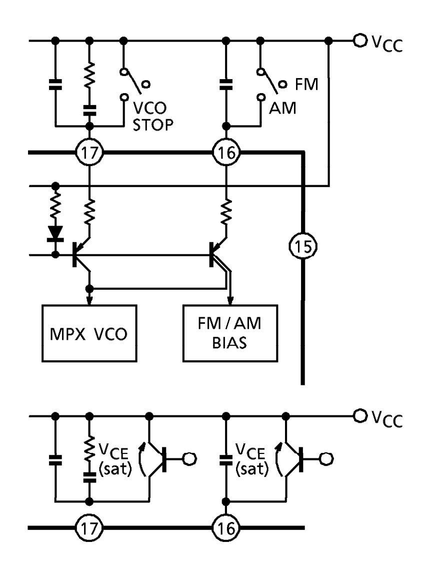
TEST FREQUENCY	C_o (pF)	Q_o	TURNS				WIRE (mmφ)	REF
			1-2	2-3	1-3	4-6		
10.7MHz	100	100	—	—	12	—	0.12 UEW	SUMIDA ELECTRIC CO., LTD 2153-4095-189 or Equivalent

8. FM / AM Switch and Forced Monaural Switch

FM / AM switch over and stere / forced monaural switch over are done by internal PNP transistors ON / OFF which are connected to pin⑯ and pin⑰ respectively.

The threshold voltages of these PNP transistors are $V_{th} = V_{CC}$, and for switching, we recommend to use mechanical switch. (Direct short to V_{CC} line.)

In the case of the electrical switch over by transistor, set up V_{CE} (saturation voltage between collector and emitter) 50mV or less, otherwise there are some cases that it does not become the AM mode and force monaural mode.
When these external switches are ON, the currents which flow into pin⑯ and pin⑰ are 100μA and 20μA respectively. (Typical value at $V_{CC} = 3V$)



MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V_{CC}	8	V
LED Current		I_{LED}	10	mA
LED Voltage		V_{LED}	8	V
Power Dissipation	TA8132AN	P_D (Note)	1200	mW
	TA8132AF		400	
Operating Temperature		T_{opr}	− 25~75	°C
Storage Temperature		T_{stg}	− 55~150	°C

Note : Derated above 25°C in the proportion of 9.6mW / °C for TA8132AN and of 3.2mW / °C for TA8132AF.

ELECTRICAL CHARACTERISTICS

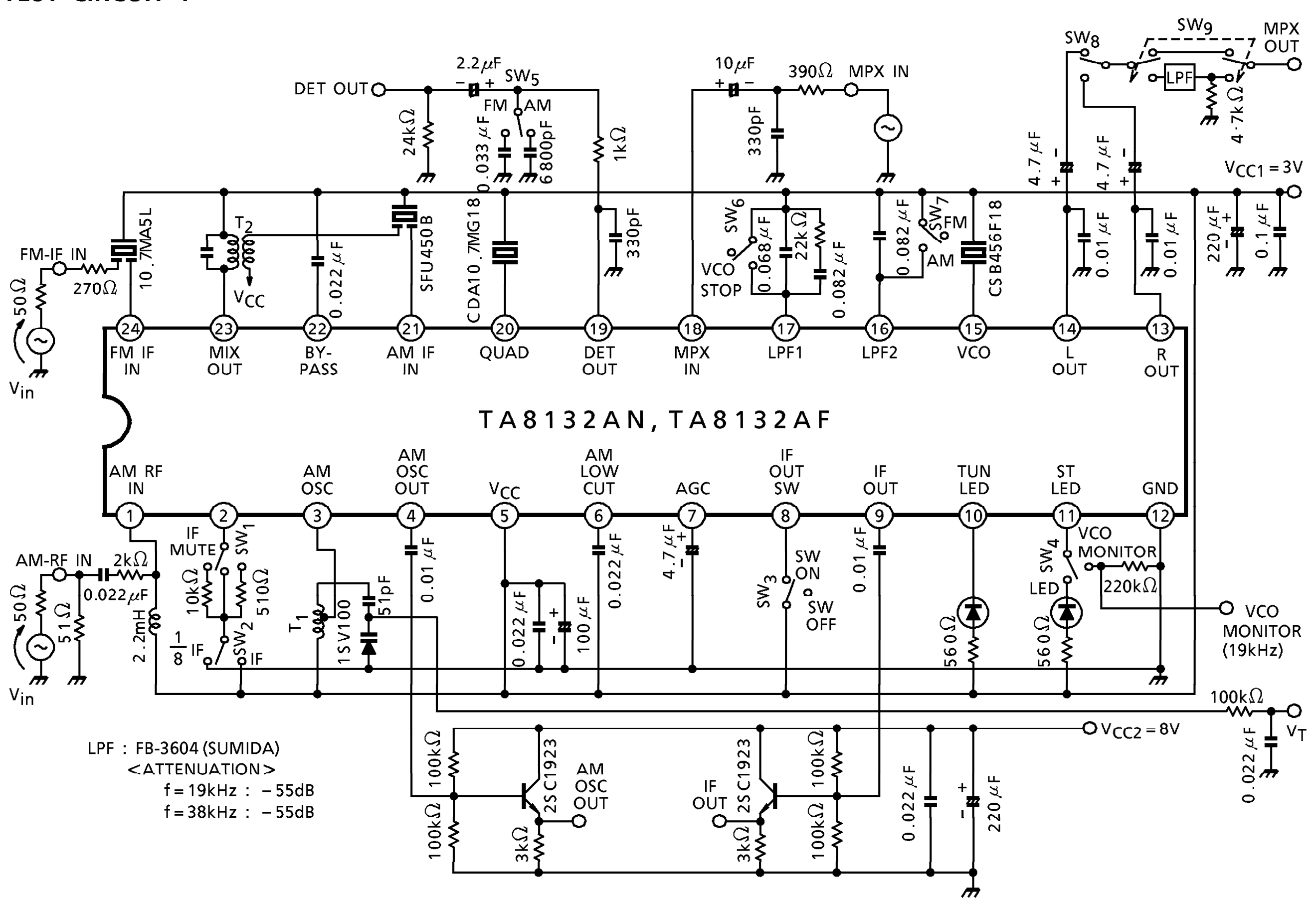
Unless otherwise specified, Ta = 25°C, V_{CC1} = 3V, SW_1→10kΩ, SW_3→OFF
FM IF : f = 10.7MHz, Δf = ±22.5kHz, f_m = 1kHz
AM : f = 1MHz, MOD = 30%, f_m = 1kHz
MPX : f_m = 1kHz

CHARACTERISTIC			SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current			I_{CC} (FM)	1	FM Mode, V_{in} = 0	—	11.0	14.0	mA
			I_{CC} (AM)	1	AM Mode, V_{in} = 0	—	10.5	13.5	
FM IF	Input Limiting Voltage		V_{in} (lim.)	1	−3dB Limiting Point	41	46	51	dBμV EMF
	Recovered Output Voltage		V_{OD}	1	V_{in} = 80dBμV EMF	50	75	100	mV_{rms}
	Signal to Noise Ratio		S / N	1	V_{in} = 80dBμV EMF	—	65	—	dB
	Total Harmonic Distortion		THD	1	V_{in} = 80dBμV EMF	—	0.2	—	%
	AM Rejection Ratio		AMR	1	V_{in} = 80dBμV EMF	—	38	—	dB
	LED ON Sensitivity		V_L	1	I_L = 1mA	48	53	58	dBμV EMF
	IF Count Output Frequency	IF	f_{IF} (FM)	1	V_{in} = 80dBμV EMF, SW_2→V_{CC}, SW_3→ON	—	10.7	—	MHz
		1 / 8 IF	$f_{1/8\ IF}$ (FM)	1	V_{in} = 80dBμV EMF, SW_2→GND, SW_3→ON	1.3374	1.3375	1.3376	
	IF Count Output Voltage	IF	V_{IF} (FM)	1	V_{in} = 61dBμV EMF, SW_2→V_{CC}, SW_3→ON	350	500	—	mV_{p-p}
		1 / 8 IF	$V_{1/8\ IF}$ (FM)	1	V_{in} = 61dBμV EMF, SW_2→GND, SW_3→ON	350	500	—	
	IF Count Output Sensitivity		$IF_{sens.}$ (FM)	1	SW_1→0, SW_2→GND, SW_3→ON	—	76	—	dBμV EMF
					SW_1→510Ω, SW_2→GND, SW_3→ON	—	68	—	
					SW_1→0, SW_2→V_{CC}, SW_3→ON	—	77	—	
					SW_1→510Ω, SW_2→V_{CC}, SW_3→ON	—	69	—	

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
AM	Gain	G_V	1	V_{in} = 26dBμV EMF	28	57	85	mV_{rms}
	Recovered Output Voltage	V_{OD}	1	V_{in} = 60dBμV EMF	50	75	100	
	Signal to Noise Ratio	S / N	1	V_{in} = 60dBμV EMF	—	41	—	dB
	Total Harmonic Distortion	THD	1	V_{in} = 60dBμV EMF	—	1.0	—	%
	LED ON Sensitivity	V_L	1	I_L = 1mA	21	26	31	dBμV EMF
	Local OSC Buff. Output Voltage	V_{OSC} (AM)	1	f_{OSC} = 1.45MHz	350	500	—	mV_{p-p}
			2	f_{OSC} = 27MHz	—	500	—	
	IF Count Output Voltage	V_{IF} (AM)	1	V_{in} = 39dBμV EMF, SW_3→ON	350	500	—	mV_{p-p}
	IF Count Output Sensitivity	$IF_{sens.}$ (AM)	1	SW_1→0, SW_2→GND, SW_3→ON	—	49	—	dBμV EMF
				SW_1→510Ω, SW_2→GND, SW_3→ON	—	42	—	
				SW_1→0, SW_2→V_{CC}, SW_3→ON	—	49	—	
				SW_1→510Ω, SW_2→V_{CC}, SW_3→ON	—	42	—	
Pin⑲ Output Resistance		R_{19}	1	FM Mode	—	0.6	—	kΩ
				AM Mode	—	12	—	

CHARACTERISTIC			SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
MPX	Input Resistance		R_{IN}	1	—		—	25	—	kΩ
	Output Resistance		R_{OUT}	1	—		—	5	—	kΩ
	Max. Composite Signal Input Voltage		V_{in} MAX (Stereo)	1	L + R = 90%, P = 10% THD = 3%, SW_9→LPF : ON		—	350	—	mV_{rms}
	Separation		Sep	—	L + R = $135mV_{rms}$ P = $15mV_{rms}$, SW_9→LPF : ON	f_m = 100Hz	—	42	—	dB
						f_m = 1kHz	35	42	—	dB
						f_m = 10kHz	—	42	—	dB
	Total Harmonic Distortion	Monaural	THD (Monaural)	1	V_{in} = $150mV_{rms}$ (MONO)		—	0.2	—	%
		Stereo	THD (Stereo)	1	L + R = $135mV_{rms}$, P = $15mV_{rms}$ SW_9→LPF : ON		—	0.2	—	%
	Voltage Gain		G_V (MPX)	1	V_{in} = $150mV_{rms}$ (MONO)		−5	−3	−1	dB
	Channel Balance		C.B.	1	V_{in} = $150mV_{rms}$ (MONO)		−2	0	2	dB
	Stereo LED Sensitivity	ON	V_L (ON)	1	Pilot Input		—	8	15	mV_{rms}
		OFF	V_L (OFF)	1	Pilot Input		2	6	—	mV_{rms}
	Stereo LED Hysteresis		V_H	1	To LED turn off from LED turn on		—	2	—	mV_{rms}
	Capture Range		C.R.	1	P = $15mV_{rms}$		—	±1.3	—	%
	Signal to Noise Ratio		S / N	1	V_{in} = $150mV_{rms}$ (MONO)		—	78	—	dB

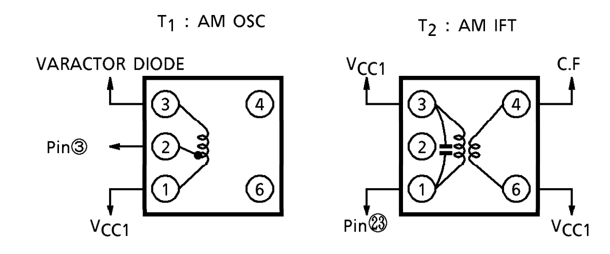
TEST CIRCUIT 1



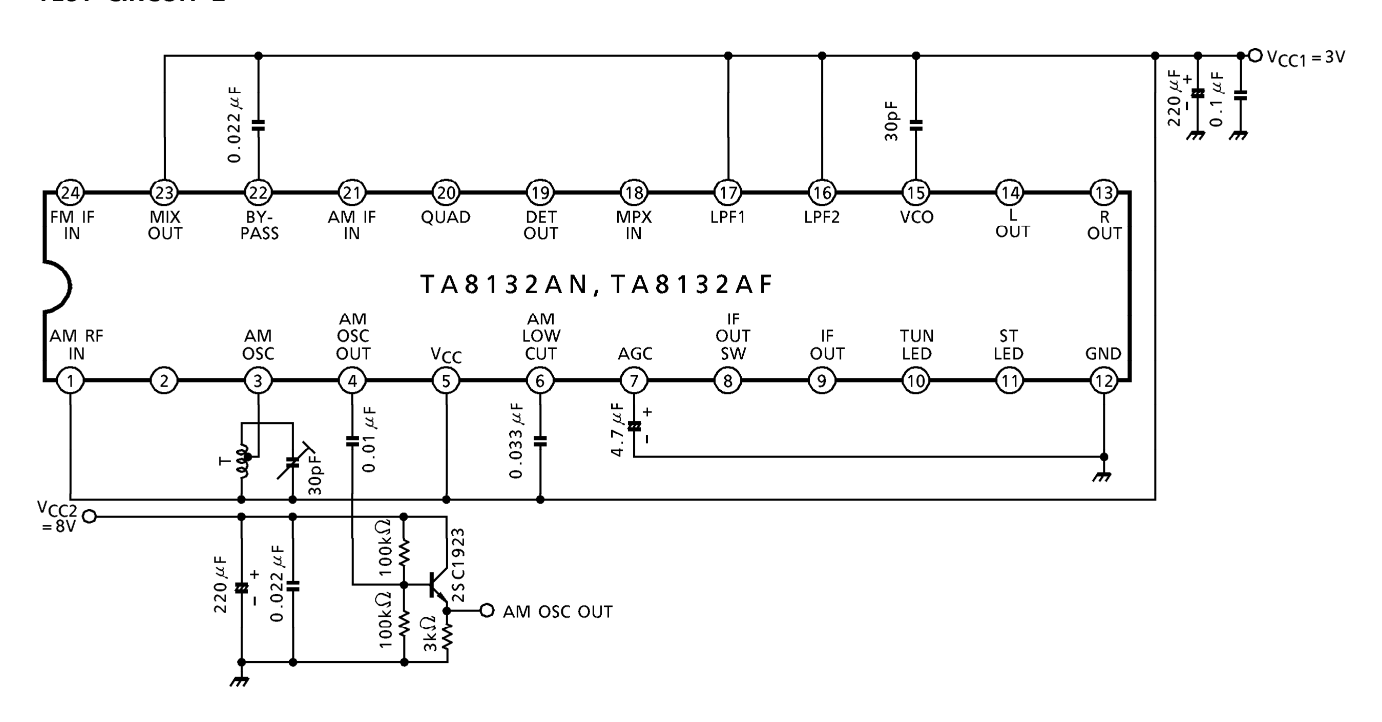
COIL DATA (TEST CIRCUIT 1)

COIL No.	f	L (μH)	C_o (pF)	Q_o	TURN 1-2	TURN 2-3	TURN 1-3	TURN 4-6	WIRE (mm)	RED. (COIL No.)
T_1 AM OSC	796kHz	288	—	115	13	73	—	—	0.08 UEW	4147-1356-038 Ⓢ
T_2 AM IFT	455kHz	—	180	120	—	—	180	15	0.06 UEW	2150-2162-165 Ⓢ

Ⓢ : SUMIDA ELECTRIC Co., Ltd.



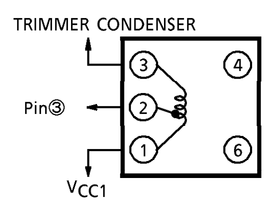
TEST CIRCUIT 2

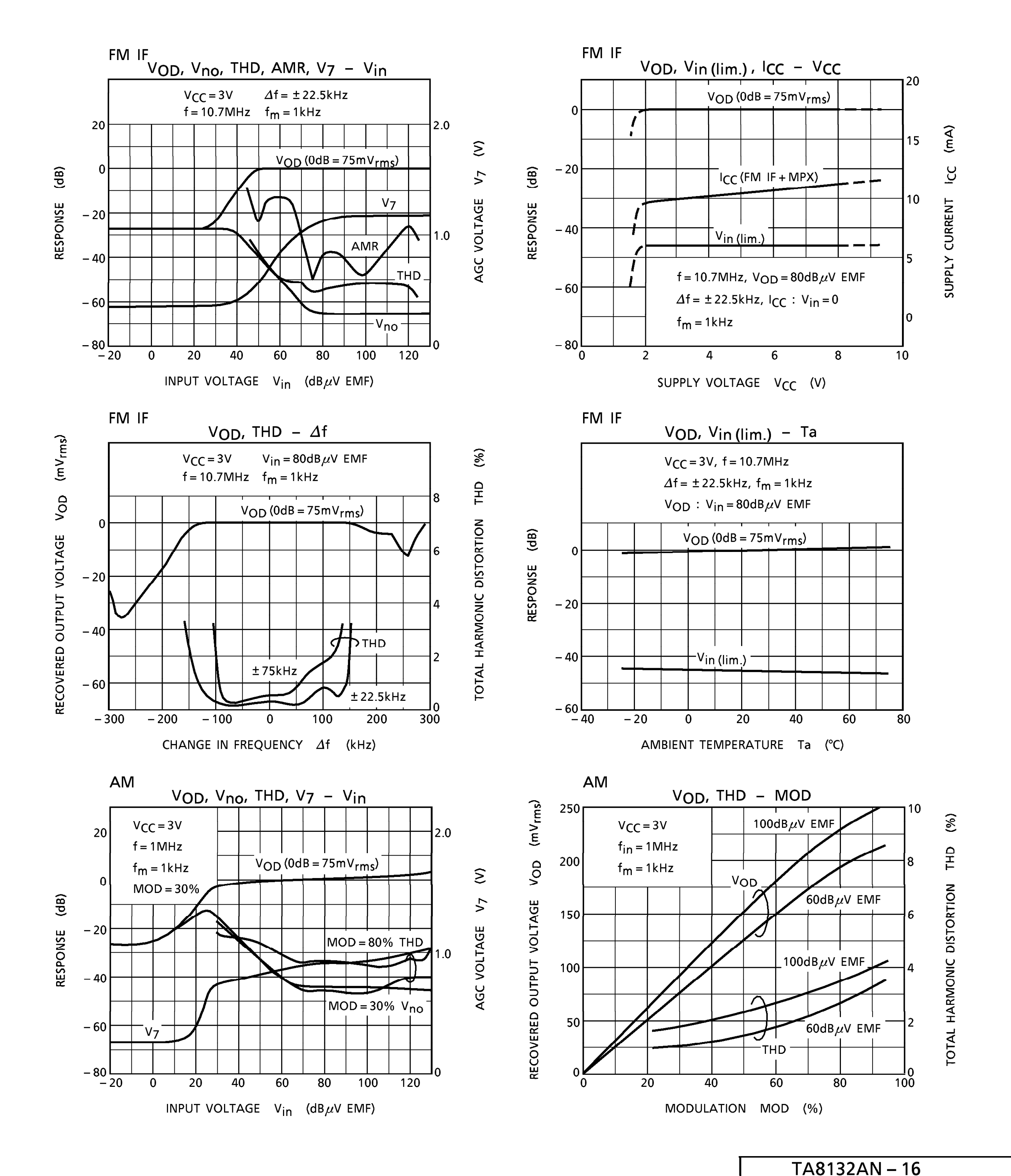


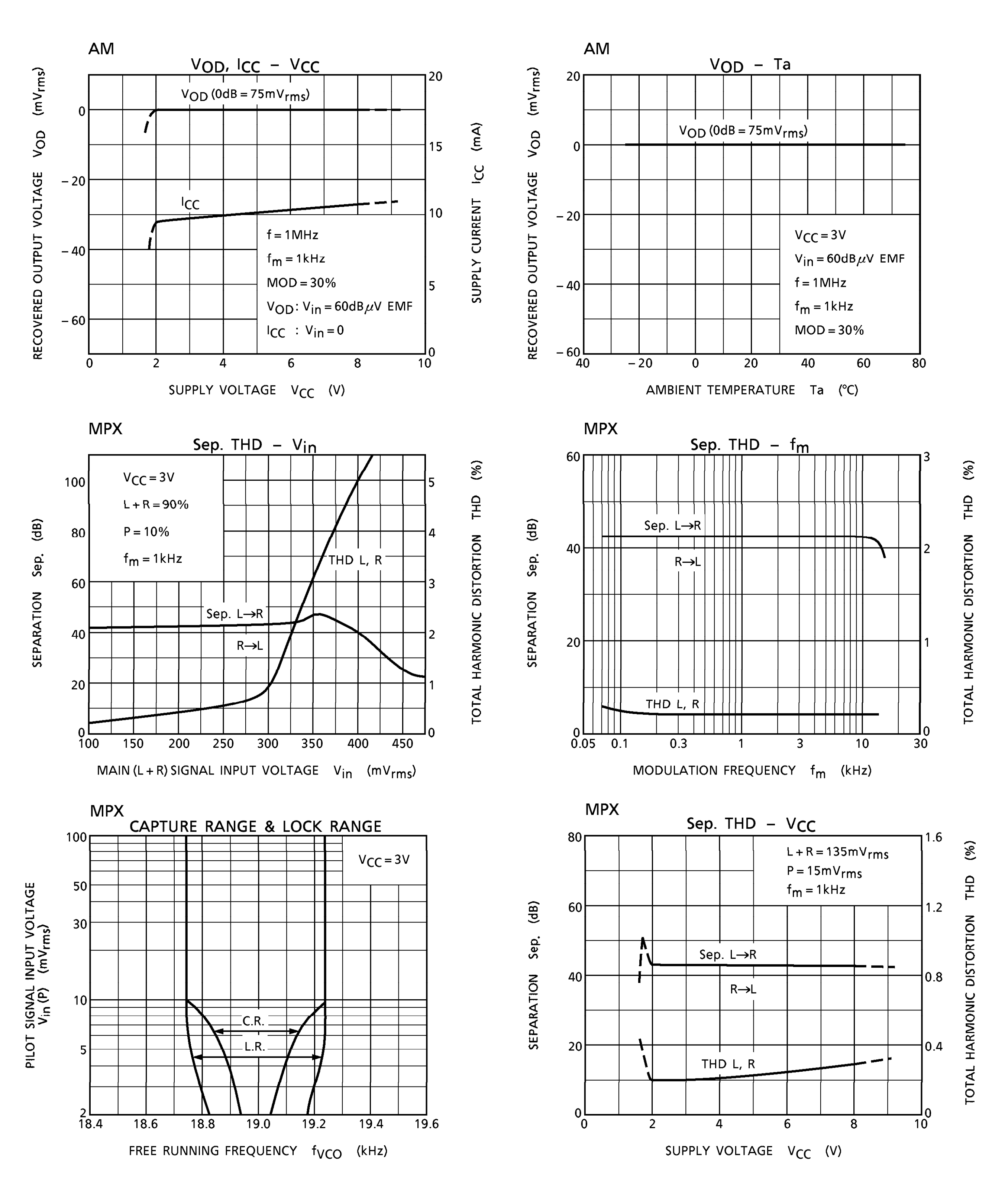
COIL DATA (TEST CIRCUIT 2)

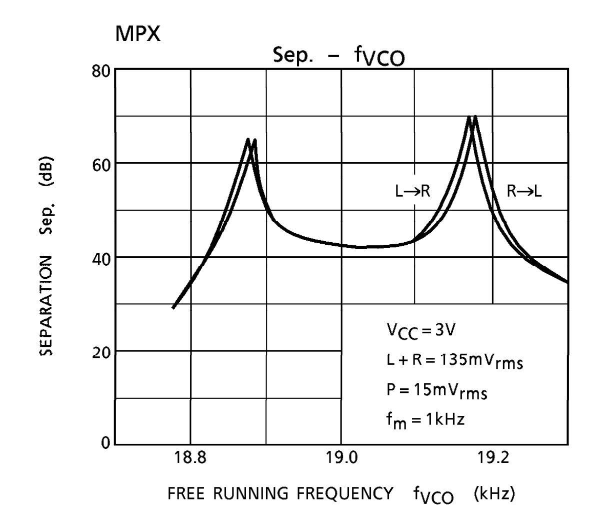
COIL No.	f	L (μH)	C_o (pF)	Q_o	TURN 1-2	TURN 2-3	TURN 1-3	TURN 4-6	WIRE (mm)	REF. (COIL No.)
T AM OSC	7.96MHz	1.4	—	84	1	6	7	—	0.08 UEW	Ⓣ 7PL-1344Y

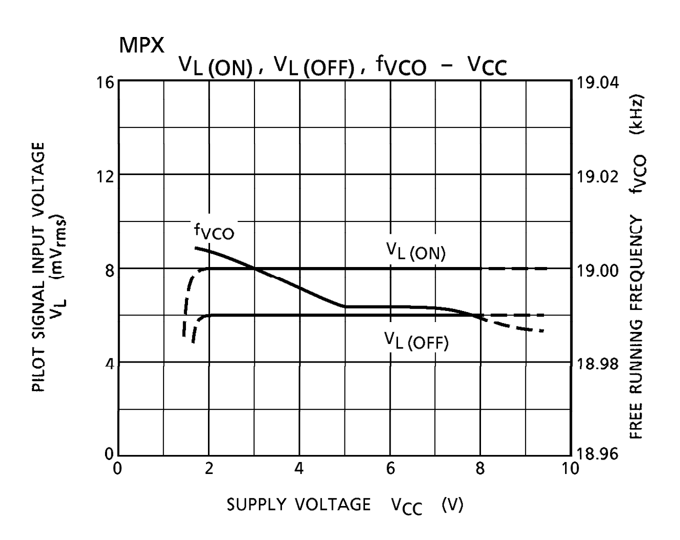
Ⓣ : TOKO Co., Ltd.




FM IF
VOD, Vno, THD, AMR, V7 – Vin
VCC = 3V Δf = ±22.5kHz
f = 10.7MHz fm = 1kHz
VOD (0dB = 75mVrms)
V7
AMR
THD
Vno
RESPONSE (dB)
AGC VOLTAGE V7 (V)
INPUT VOLTAGE Vin (dBμV EMF)
FM IF
VOD, Vin (lim.), ICC – VCC
VOD (0dB = 75mVrms)
ICC (FM IF + MPX)
Vin (lim.)
f = 10.7MHz, VOD = 80dBμV EMF
Δf = ±22.5kHz, ICC : Vin = 0
fm = 1kHz
RESPONSE (dB)
SUPPLY CURRENT ICC (mA)
SUPPLY VOLTAGE VCC (V)
FM IF
VOD, THD – Δf
VCC = 3V Vin = 80dBμV EMF
f = 10.7MHz fm = 1kHz
VOD (0dB = 75mVrms)
THD
±75kHz
±22.5kHz
RECOVERED OUTPUT VOLTAGE VOD (mVrms)
TOTAL HARMONIC DISTORTION THD (%)
CHANGE IN FREQUENCY Δf (kHz)
FM IF
VOD, Vin (lim.) – Ta
VCC = 3V, f = 10.7MHz
Δf = ±22.5kHz, fm = 1kHz
VOD : Vin = 80dBμV EMF
VOD (0dB = 75mVrms)
Vin (lim.)
RESPONSE (dB)
AMBIENT TEMPERATURE Ta (°C)
AM
VOD, Vno, THD, V7 – Vin
VCC = 3V
f = 1MHz
fm = 1kHz
MOD = 30%
VOD (0dB = 75mVrms)
MOD = 80% THD
MOD = 30% Vno
V7
RESPONSE (dB)
AGC VOLTAGE V7 (V)
INPUT VOLTAGE Vin (dBμV EMF)
AM
VOD, THD – MOD
VCC = 3V
fin = 1MHz
fm = 1kHz
100dBμV EMF
VOD
60dBμV EMF
100dBμV EMF
60dBμV EMF
THD
RECOVERED OUTPUT VOLTAGE VOD (mVrms)
TOTAL HARMONIC DISTORTION THD (%)
MODULATION MOD (%)

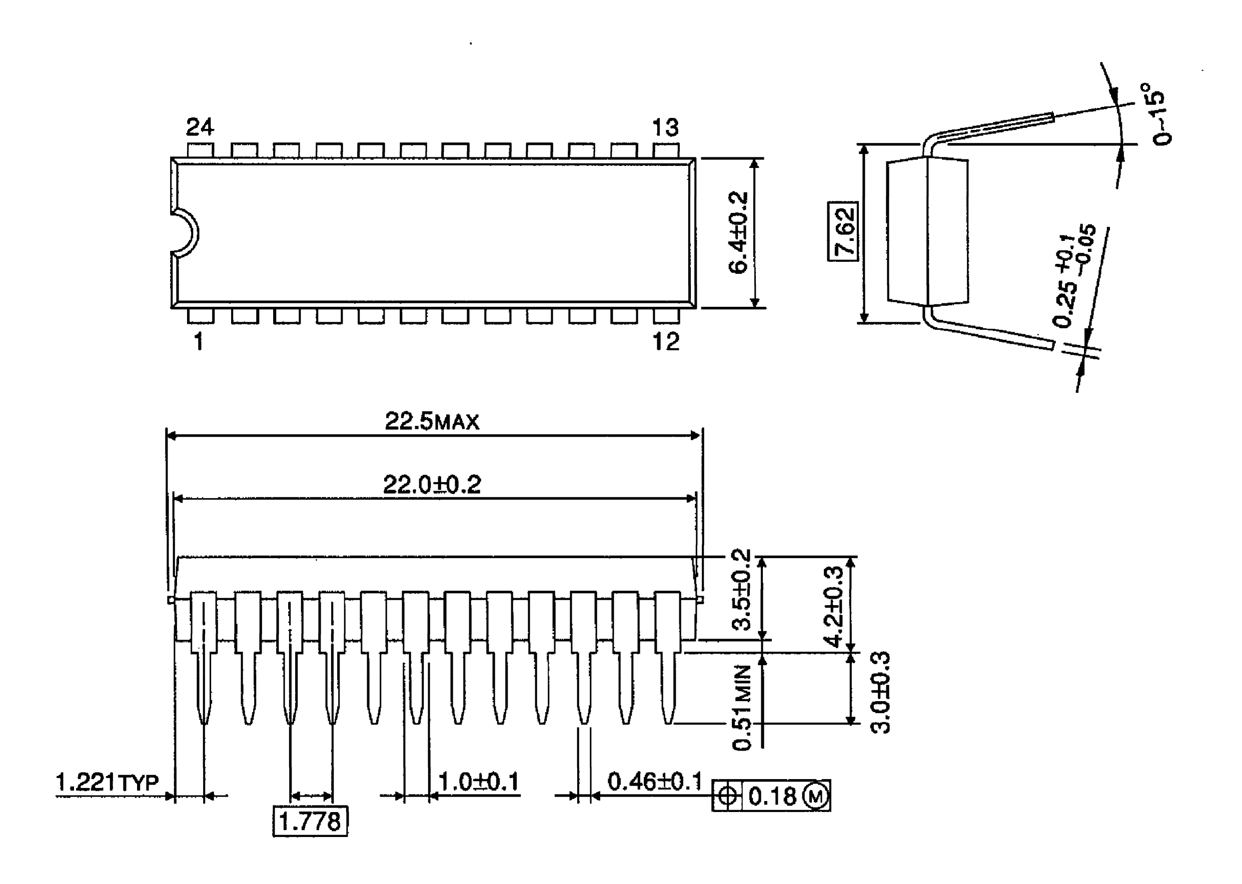

AM
VOD, ICC – VCC
VOD (0dB = 75mVrms)
ICC
f = 1MHz
fm = 1kHz
MOD = 30%
VOD : Vin = 60dBμV EMF
ICC : Vin = 0
RECOVERED OUTPUT VOLTAGE VOD (mVrms)
SUPPLY CURRENT ICC (mA)
SUPPLY VOLTAGE VCC (V)
AM
VOD – Ta
VOD (0dB = 75mVrms)
VCC = 3V
Vin = 60dBμV EMF
f = 1MHz
fm = 1kHz
MOD = 30%
RECOVERED OUTPUT VOLTAGE VOD (mVrms)
AMBIENT TEMPERATURE Ta (°C)
MPX
Sep. THD – Vin
VCC = 3V
L + R = 90%
P = 10%
fm = 1kHz
THD L, R
Sep. L→R
R→L
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
MAIN (L + R) SIGNAL INPUT VOLTAGE Vin (mVrms)
MPX
Sep. THD – fm
Sep. L→R
R→L
THD L, R
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
MODULATION FREQUENCY fm (kHz)
MPX
CAPTURE RANGE & LOCK RANGE
VCC = 3V
C.R.
L.R.
PILOT SIGNAL INPUT VOLTAGE Vin (P) (mVrms)
FREE RUNNING FREQUENCY fVCO (kHz)
MPX
Sep. THD – VCC
L + R = 135mVrms
P = 15mVrms
fm = 1kHz
Sep. L→R
R→L
THD L, R
SEPARATION Sep. (dB)
TOTAL HARMONIC DISTORTION THD (%)
SUPPLY VOLTAGE VCC (V)


MPX
Sep. – fVCO
SEPARATION Sep. (dB)
80
60
40
20
0
L→R
R→L
VCC = 3V
L + R = 135mVrms
P = 15mVrms
fm = 1kHz
18.8
19.0
19.2
FREE RUNNING FREQUENCY fVCO (kHz)


MPX
VL (ON), VL (OFF), fVCO – VCC
PILOT SIGNAL INPUT VOLTAGE VL (mVrms)
16
12
8
4
0
fVCO
VL (ON)
VL (OFF)
19.04
19.02
19.00
18.98
18.96
FREE RUNNING FREQUENCY fVCO (kHz)
0
2
4
6
8
10
SUPPLY VOLTAGE VCC (V)

OUTLINE DRAWING
SDIP24-P-300

Unit : mm



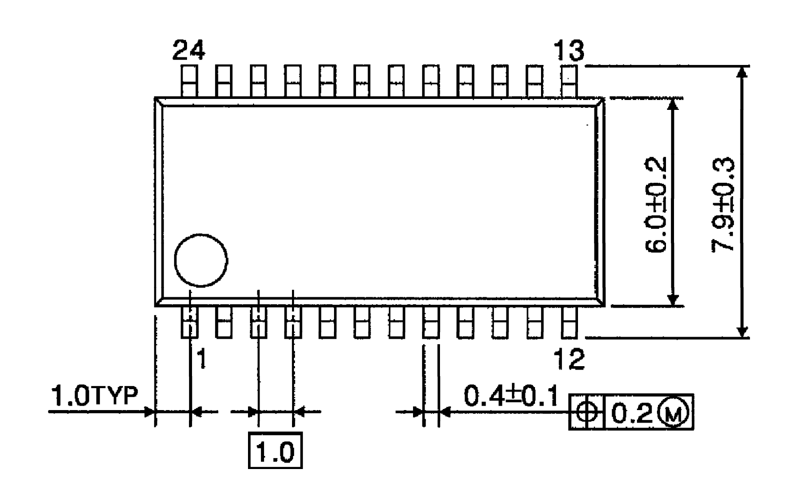
Weight : 1.2g (Typ.)

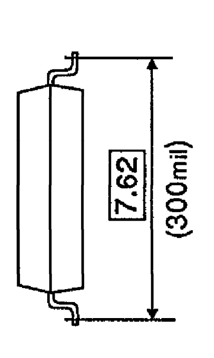


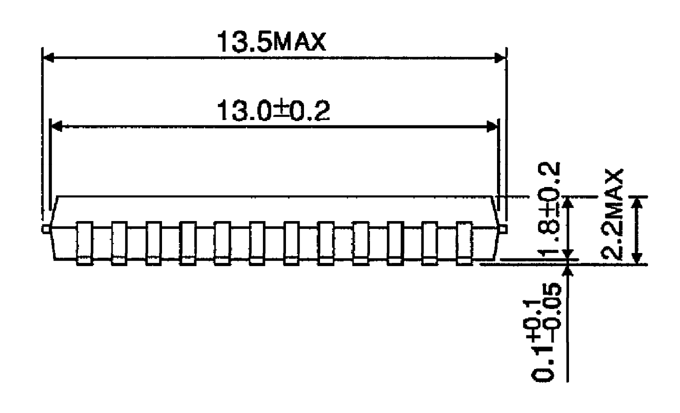
OUTLINE DRAWING

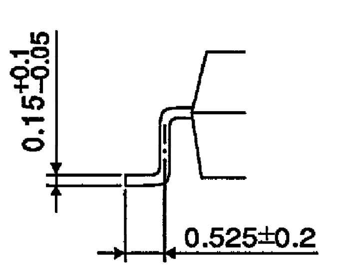
SSOP24-P-300

Unit : mm









Weight : 0.31g (Typ.)